4.0 Environmental Consequences

4.1 Introduction

The alternatives in this EA present options for conducting research on reducing fishery interactions with endangered and threatened turtles in the Pacific Ocean.

4.2 Effects of All Alternatives on Physical Resource Issues

4.2.1 Alternative 1 - No Action (No Permit Issued)

Although the area north of the equator is closed, it is believed that some of the vessels that have historically fished that area have relocated to California and to American Samoa (Peterson, 2001. pers. comm).

4.2.2 Alternative 2 (Proposed Action) - Issuance of the permit as requested by the applicant

Even without the research being conducted, the affected vessels have an opportunity to relocate and no net loss of fishing activity, for the basin as a whole, would be anticipated. The impact to the physical environment from the proposed action alternative would be similar to that of the no-action alternative.

4.2.3 Alternative 3 - Issue the permit based on a high confidence sampling for the minor gear modification (test use of blue-dyed bait and moving branch line)

This alternative would increase the number of vessels operating under the permit. However, even without the research being conducted, the affected vessels have an opportunity to relocate and no net loss of fishing activity, for the basin as a whole, would be anticipated. The impact to the physical environment from this alternative would be similar to that of the no-action alternative.

4.2.4 Alternative 4- Issue the permit based on a one-year design

This alternative would decrease the number of vessels operating under the permit. However, even without the research being conducted, the affected vessels have an opportunity to relocate and no net loss of fishing activity, for the basin as a whole, would be anticipated. The impact to the physical environment from this alternative would be similar to that of the no-action alternative.

4.2.5 Alternative 5- Issue the permit without the stealth gear and deep-set daytime fishing CPUE

Three vessels would not be contracted under this alternative. However, even without the research being conducted, the affected vessels have an opportunity to relocate and no net loss of fishing activity, for the basin as a whole, would be anticipated. The impact to the physical environment from this alternative would be similar to that of the no-action alternative.

4.3 Effects of All Alternatives on Biological Resource Issues

4.3.1 Alternative 1 - No Action (No Permit Issued)

Under this alternative, the proposed research would not be conducted and there would be no effect on biological resources. However, data regarding differing gear configurations and turtle interactions would not be obtained. This alternative does not reach the objective of the proposed action: "to conduct research that will lead to a reduction in the number of sea turtles incidentally caught in the U.S. pelagic longline fishery in the Pacific ocean, and potentially in longline fisheries throughout the Pacific ocean that incidentally capture endangered and threatened sea turtles." Fishing experiments are critical to developing gear technologies and fishing strategies for reducing sea turtle capture rates throughout the Pacific Ocean. Developing a gear technology or fishing strategy that is capable of significantly reducing sea turtle capture rates by longline vessels is essential if the U.S. is going to cultivate an open dialogue between the international community to formulate collaborative efforts to address the incidental sea turtle interaction problem. The no action alternative may have potential long-term costs to the recovery of sea turtles species if measures are not developed to reduce sea turtle bycatch both domestically and abroad.

4.3.2 Alternative 2 (Proposed Action) - Issuance of the permit as requested in the application

The proposed action is the issuance of a scientific research permit to conduct experiments to evaluate the effectiveness of modifications to longline fishing gear to reduce the bycatch of sea turtles using swordfish- and tuna-style fishing operations under an ESA Section 10 permit for scientific research.

Sea Turtles

The proposed experiment provided in the application would take 233 threatened loggerhead turtles, 24 threatened/endangered olive ridley turtles, 15 threatened/endangered green turtles and 44 endangered leatherback turtles over the life of the permit. These direct takes will be the only take of sea turtles in the Pacific Ocean by swordfish style fishing, however, they are in addition to the incidental take expected in the commercial fishery operating in other areas authorized in the Incidental Take Statement of the March 29, 2001, opinion.

The March 29, 2001, opinion and the biological opinion prepared on the issuance of this permit comprehensively describe the effects of capture in longline fishing gear on sea turtles. The discussion includes the effects of forced submergence, entanglement, hooking, trailing gear and transportation of deeply hooked turtles. That discussion is presented here to ensure clarity between the documents. Additionally, the research activities proposed to be performed on the turtles including handling for the collection of standard measurements, flipper and PIT tagging, collection of tissue samples and attachment of satellite transmitters is also presented.

Detailed analysis of the effects on each of the individual sea turtle species proposed to be taken under permit #1303 are evaluated in the biological opinion prepared on the issuance of this proposed permit, and are not repeated here.

Effects of Forced Submergence

Sea turtles can be forcibly submerged by longline gear either through a hooking or entanglement event, where the turtle is unable to reach the surface to breathe. This can occur at any time during the set, including the setting and hauling of the gear, and generally occurs when the sea turtle encounters a line that is too short to reach the surface or is too heavy to be brought up to the surface by a swimming sea turtle. For example, a sea turtle that is hooked on a 3 meter branchline attached to a mainline set at depth by a 6 meter floatline will generally not be able to swim to the surface unless it has the strength to drag the mainline approximately 3 more meters (discussed further below).

Turtles hooked by longline gear will sometimes drag the clip, attached to the branch line, along the main line. If this happens, the potential exists for a turtle to become entangled in an adjacent branch line which may have another species hooked such as a shark, swordfish, or tuna. According to observer reports, most of the sharks and some of the larger tuna such as bigeye are still alive when they are retrieved aboard the vessel, whereas most of the swordfish are dead. If a turtle were to drag the branch line up against a branch line with a live shark or bigeye tuna attached, the likelihood of the turtle becoming entangled in the branch line is greater. If the turtle becomes entangled in the gear, then the turtle may be prevented from reaching the surface. The potential also exists, that if a turtle drags the dropper line next to a float line, the turtle may wrap itself around the float line and become entangled.

Sea turtles that are forcibly submerged by longline gear undergo respiratory and metabolic stress that can lead to severe disturbance of their acid-base balance. While most voluntary dives by sea turtles appear to be aerobic, showing little if any increases in blood lactate and only minor changes in acid-base status (pH level of the blood), sea turtles that are stressed as a result of being forcibly submerged through hooking or entanglement in a line rapidly consume oxygen stores, triggering an activation of anaerobic glycolysis, and subsequently disturbing their acid-base balance, sometimes to lethal levels. It is likely that the rapidity and extent of the physiological changes that occur during forced submergence are functions of the intensity of struggling as well as the length of submergence (Lutcavage and Lutz, 1997). In a field study examining the effects of shrimp trawl tow times and sea turtle deaths, there was a strong positive correlation between the length of time of the tow and sea turtle deaths (Henwood and Stuntz, 1987, *in* Lutcavage and Lutz, 1997).

Sea turtles forcibly submerged for extended periods of time show marked, even severe, metabolic acidosis as a result of high blood lactate levels. With such increased lactate levels, lactate recovery times are long (even as much as 20 hours), indicating that turtles are probably more susceptible to lethal metabolic acidosis if they experience multiple captures in a short period of time, because they would not have had time to process lactic acid loads (*in* Lutcavage and Lutz, 1997). Presumably, however, a sea turtle recovering from a forced submergence would most likely remain resting on the surface (given that it had the energy stores to do so), which would reduce the likelihood of being recaptured by a submerged longline. Recapture would also depend on the condition of the turtle and the intensity of fishing pressure in the area. NMFS has no information on the likelihood of

recapture of sea turtles by the Hawaii-based longline fishery or other fisheries. However, in the Atlantic Ocean, turtles have been reported as captured more than once by longliners (on subsequent days), as observers reported clean hooks already in the jaw of captured turtles. Such multiple captures were thought to be most likely on three or four trips that had the highest number of interactions (Hoey, 1998).

Respiratory and metabolic stress due to forcible submergence is also correlated with additional factors such as size and activity of the sea turtle (including dive limits), water temperature, and biological and behavioral differences between species and will therefore also affect the survivability on a longline. For example, larger sea turtles are capable of longer voluntary dives than small turtles, so juveniles may be more vulnerable to the stress of forced submergence than adults. During the warmer months, routine metabolic rates are higher, so the impacts of the stress due to entanglement or hooking may be magnified. In addition, disease factors and hormonal status may also play a role in anoxic survival during forced submergence. Any disease that causes a reduction in the blood oxygen transport capacity could severely reduce a sea turtle's endurance on a longline, and since thyroid hormones appear to have a role in setting metabolic rate, they may also play a role in increasing or reducing the survival rate of an entangled sea turtle (*in* Lutz and Lutcavage, 1997). Turtles necropsied following capture (and subsequent death) by longliners in the Hawaii-based longline fishery were found to have pathologic lesions. Two of the seven turtles (both leatherbacks) had lesions severe enough to cause probable organ dysfunction, although whether or not the lesions predisposed these turtles to being hooked could not be determined (Work, 2000). As discussed further in the leatherback and loggerhead subsections below, some sea turtle species are better equipped to deal with forced submergence.

Although a low percentage of turtles that are captured by longliners actually are reported dead, sea turtles can drown from being forcibly submerged. Such drowning may be either "wet" or "dry." In the case of dry drowning, a reflex spasm seals the lungs from both air and water. With wet drowning, water enters the lungs, causing damage to the organs and/or causing asphyxiation, leading to death. Before death due to drowning occurs, sea turtles may become comatose or unconscious. Studies have shown that sea turtles that are allowed time to stabilize after being forcibly submerged have a higher survival rate. This of course depends on the physiological condition of the turtle (e.g. overall health, age, size), time of last breath, time of submergence, environmental conditions (e.g. sea surface temperature, wave action, etc.), and the nature of any sustained injuries at the time of submergence (NRC, 1990).

Effects of entanglement

Sea turtles are particularly prone to entanglement as a result of their body configuration and behavior. Records of stranded or entangled sea turtles reveal that fishing debris can wrap around the neck or flipper, or body of a sea turtle and severely restrict swimming or feeding. Over time, if the sea turtle is entangled when young, the fishing line will become tighter and more constricting as the sea turtle grows, cutting off blood flow, causing deep gashes, some severe enough to remove an appendage. Sea turtles have also been found

trailing gear that has been snagged on the bottom, thus causing them to be anchored in place (Balazs, 1985).

Sea turtles have been found entangled in branchlines (gangions), mainlines and float lines. Longline gear is fluid and can move according to oceanographic conditions determined by wind and waves, surface and subsurface currents, etc.; therefore, depending on both sea turtle behavior, environmental conditions, and location of the set, turtles could be entangled in longline gear. Entanglement in monofilament line (mainline or gangion) or polypropylene (float line) could result in substantial wounds, including cuts, constriction, or bleeding on any body part. In addition entanglement could directly or indirectly interfere with mobility, causing impairment in feeding, breeding, or migration. Sea turtles entangled by longline gear are most often entangled around their neck and foreflippers, and, often in the case of leatherback entanglements, turtles have been found snarled in the mainline, floatline, and the branchline (Hoey, 2000).

Effects of hooking

In addition to being entangled in a longline, sea turtles are also injured and killed by being hooked. Hooking can occur as a result of a variety of scenarios, some of which will depend on foraging strategies and diving and swimming behavior of the various species of sea turtles. For example, olive ridleys that were killed by the Hawaii-based longline fishery and were necropsied have been found with bait in their stomachs after being hooked; therefore, they most likely were attracted to the bait and attacked the hook. In addition, leatherbacks, loggerheads and olive ridleys have all been found foraging on pyrosomas which bioluminesce at night. If lightsticks are used on a swordfish set at night to attract the target species, the turtles could mistake the lightsticks for their preferred prey and get hooked externally or internally by a nearby hook. Similarly, a turtle could concurrently be foraging in or migrating through an area where the longline is set and could be hooked at any time during the setting, hauling, or soaking process.

Sea turtles are either hooked externally - generally in the flippers, head, beak, or mouth - or internally, where the animal has attempted to forage on the bait, and the hook is ingested into the gastro-intestinal tract, often a major site of hooking (E. Jacobson, *in* Balazs, *et al.*, 1995). Even if the hook is removed, which is often possible with a lightly hooked (i.e. externally hooked) turtle, the hooking interaction is believed to be a significant event. Like most vertebrates, the digestive tract of the sea turtle begins in the mouth, through the esophagus, and then dilates into the stomach. The esophagus is lined by strong conical papillae, which are directed caudally towards the stomach (White, 1994). The existence of these papillae, coupled with the fact that the esophagus snakes into an s-shaped bend further towards the tail make it difficult to see hooks, especially when deeply ingested. Not surprisingly, and for those same reasons, a deeply ingested hook is also very difficult to remove from a turtle's mouth without significant injury to the animal. The esophagus is attached fairly firmly to underlying tissue; therefore, when a hook is ingested, the process of movement, either by the turtle's attempt to get free of the hook or by being hauled in by the vessel, can traumatize the internal organs of the turtle, either by piercing the esophagus, stomach, or other organs, or by pulling the organs from their connective

tissue. Once the hook is set and pierces an organ, infection may ensue, which may result in death to the animal.

If a hook does not become lodged or pierce an organ, it can pass through to the colon, or even expelled through the turtle (E. Jacobson *in* Balazs, *et al.*, 1995). In such cases, sea turtles are able to pass hooks through the digestive track with little damage (Work, 2000). Of 38 loggerheads deeply hooked by the Spanish Mediterranean longline fleet and subsequently held in captivity, six loggerheads expelled hooks after 53 to 285 days (average 118 days) (Aguilar, *et al.*, 1995) . If a hook passes through a turtle's digestive tract without getting lodged, the chances are good that less damage has been done. Tissue necrosis that may have developed around the hook may also get passed along through the turtle as a foreign body (E. Jacobson, *in* Balazs, *et al.*, 1995).

Effects of trailing gear

Trailing line (i.e. line that is left on a turtle after it has been captured and released), particularly line trailing from an ingested hook, poses a serious risk to sea turtles. Line trailing from an ingested hook is likely to be swallowed, which may occlude the gastrointestinal tract, preventing or hampering foraging, leading to eventual death. Trailing line may also become snagged on a floating or fixed object, resulting in further entanglement, with potential loss of appendages, which may affect mobility, feeding, predator evasion, or reproduction. For the scientific research conducted under this permit, all sets will be supervised by NMFS employees or contracted biologists, technicians, or fishery observers. In the event that a hook cannot be removed from a turtle, these personnel will be responsible for and are directed to clip the line as close to the hook as possible in order to minimize the amount of trailing gear. This is difficult with larger turtles, such as the leatherback, which often cannot practicably be brought on board the vessel, or in inclement weather, when such action might place the observer or the vessel and its crew at risk. Clipping and/or removing the trailing gear should reduce effects to sea turtles.

Effects of transportation of turtles

After capture, some deeply-hooked hard-shelled turtles will be brought onboard fishing vessels contracted for this experiment and transported to the dock (those captured within a 72 hour journey to port). The turtles will be treated in accordance with conditions outlined in the permit (also described in the *Description of the Proposed Action* section) and in accordance with CFR §223.206(d)(1) - NMFS handling and resuscitation requirements for incidentally taken sea turtles. The applicants anticipate that a total of 3 greens, 14 loggerheads, and 12 olive ridleys will be transported to a facility in Honolulu.

Turtles are to be transported via a climate-controlled environment, protected from temperature extremes of heat and cold, and kept moist. The turtle will be placed on pads for cushioning and the area surrounding the turtle will be free of any materials that could be accidentally ingested. Turtles have been transported using these methods for 30 years by stranding network participants without any adverse effect to the turtles.

Turtles transported to a facility for rehabilitation will be maintained and cared for under the "Care and Maintenance Guidelines for Sea Turtles Held in Captivity" issued by the U.S. Fish and Wildlife Service dated August 1997. While held at the facility, turtles will have plentiful food, shelter, and antibiotics. In addition, if necessary, turtles will be fed supplements and vitamins to take care of any deficiencies (Walsh, 1999).

Based on past experience with stranding and salvage network participants using these transport and holding techniques, NMFS does not expect that the transport and holding of sea turtles, in accordance with the special conditions of the permit, will cause any additional stress or discomfort to the turtle. In fact, because of the close care, treatment, and supervision the turtles will receive once they arrive at the facility, NMFS believes that the survival rate of the deeply hooked turtles will be higher than if the turtles had been released into the ocean soon after being captured.

Effects of Standard Measurement Collection

Standard measurements and weight are collected and associated with the tag number assigned to the turtle. Should the turtle be recaptured, weight and measurements of the two captured can be compared to measure growth. The effects of this harassment of the turtles during capture and handling, can result in raised levels of stressor hormones, and can cause some discomfort during tagging procedures. Based on past observations of similar research, these effects are expected to dissipate within a day (Stabenau and Vietti, 1999).

Effects of Flipper Tagging and Injection of PIT Tags

The purpose of flipper and PIT tagging is to enable re-identification of individual turtles over the life of the study, and during any other research studies that may be conducted during the future in the action area. Tag numbers are entered into a central database so that they can be retrieved by other researchers. This is consistent with section 10 permit special conditions requiring information sharing among researchers in the action area.

Flipper tags are commonly made of either plastic or titanium. Flipper tagging has been used for more than 20 years (Balazs, 1999) to track sea turtle movement and growth. All tag types have negatives associated with them, especially concerning tag retention. Plastic tags can become brittle, break and fall off underwater, and titanium tags can bend during implantation and thus not close properly, leading to tag loss. The small wound-site resulting from a tag applied to the flipper should heal completely in a short period of time, similar to what happens when a person's ear is pierced for an earring. The risk of infection is low, because the equipment and tag are sterilized prior to tagging of each turtle.

PIT tags are small inert microprocessors sealed in glass that can transmit a unique identification number to a hand-held reader when the reader briefly activates that tag with a low frequency radio signal at close range. PIT tags range in size from 11.5 x 2.1 mm to 20.0 x 3.2 mm. Over time, PIT tags can migrate within body tissue making it necessary to scan the entire surface of the implantation area. PIT tags have the advantage of being encased in glass, which makes them inert, and are positioned inside the turtle where loss or

damage over time due to abrasion, breakage, corrosion or age over time is virtually non-existent (Balazs, 1999).

The application of all types of tags will produce some level of pain to the turtle receiving the tag (Balazs, 1999). The discomfort displayed is usually short and highly variable between individuals. Balazs (1999) states that most turtles barely seem to notice, while others exhibit a marked response. No post-tagging infection has been noted. NMFS does not anticipate any mortality or long term adverse effect to the turtle with the attachment of flipper tags or insertion of PIT tags.

Effects of Tissue Samples Collection

Tissue sampling is done with a sterile tissue punch. The sample location will depend on the species of turtle and wether the turtle is brought aboard the vessel. If the turtle is brought aboard the vessel, the turtle will have a tissue sample collected from the fleshy area between the rear flippers and below the plastron. If the turtle is too large to bring aboard the vessel (e.g. a leatherback turtle), the sample will be collected from the location most easily accessed by the researcher/observer (usually the flipper). Samples will be collected from anywhere on the limbs or neck, avoiding the head. Samples may be collected from the carapace of the leatherback turtle if necessary. For all tissue sample collections, a sterile 6mm punch sampler is used. If the animal is able to be landed onboard the vessel, the sample area is swabbed with alcohol to clean it before the sample is collected. Researchers who examined turtles caught two to three weeks after sample collection noted the sample collection site was almost completely healed (Witzel, pers. comm.). NMFS does not expect that the collection of a tissue sample will cause any additional stress or discomfort to the turtle beyond what was experienced during capture, collection of measurements and tagging.

Effects of Satellite Transmitter Attachment

Satellite tags are attached to turtles to track their movements in an attempt to locate areas of high use (i.e. feeding areas). As discussed earlier - two different types of satellite transmitters will be used during the experiment. Satellite transmitters will be attached using a polyester resin to the uppermost vertebral scute of the carapace. This area of the carapace is almost completely flat and provides a good base for the transmitter. The adhesive area of the carapace is to be cleaned of barnacles, algae and any other foreign materials and scrubbed with sandpaper. No chemical solvents will be used. The transmitters will be oriented so that the antennae points away from the turtle's head. The turtles are held for a short period of time to ensure that the adhesive has cured sufficiently.

NMFS observer guidelines and procedures require that turtles receiving transmitters be held for an additional two hours after processing to allow the turtle to recover from the stress of the entanglement or hooking in the fishery. During this time, turtles are kept in a shaded area and are kept cool and moist to prevent dehydration and overheating.

The proposed permit also requires that the applicants provide adequate ventilation around the turtle's head during the attachment of all transmitters. To prevent skin or eye injury

due to the chemicals in the resin during transmitter the application process, the transmitter attachment process must not take place in the water.

The permit also requires that the total weight of transmitter attachments for any one turtle must not exceed 5% of the body mass of the animal. Each attachment must be made so that there is no risk of entanglement. The transmitter attachment must either contain a weak link or have no gap between the transmitter and the turtle that could result in entanglement.

Based on past experience with these techniques used by turtle researchers and the documented effects of transmitter attachment, NMFS does not expect that attaching satellite transmitters to turtles taken during this research cause more than minor increases in stress or discomfort to the turtle beyond what was experienced during capture, collection of measurements and tagging.

Effects of Having Observers/Researchers on Every Participating Vessel

50 CFR §222.206(d)(1) (i)(B) requires commercial fisherman to attempt resuscitation of non-responsive turtles captured during commercial fishing operations. When NMFS observers are placed on board commercial vessels, these resuscitation efforts will be undertaken by the observer. In some cases, non-responsive turtles can be brought back to consciousness by placing the turtle on its bottom shell (plastron) so that the turtle is right side up and elevating its hindquarters at least 6 inches (15.2 cm) for a period of 4 up to 24 hours. The amount of the elevation depends on the size of the turtle; greater elevations are needed for larger turtles. Periodically, rock the turtle gently left to right and right to left by holding the outer edge of the shell (carapace) and lifting one side about 3 inches (7.6 cm) then alternate to the other side. It draws oxygen into the lungs and also can allow water to drain out of the lungs. Gently touch the eye and pinch the tail (reflex test) periodically to see if there is a response. The effect of these attempts can be deemed beneficial to the species. Increasing observer coverage of the fishery, and thus the numbers of observers on boats will also increase the effectiveness of this technique and ensure that it is being correctly implemented.

The proposed research requires that a NMFS observer or NMFS-trained contractor be onboard any vessel operating under the permit. They are intended to serve as both trained handlers for removing lines, hooks and nets, resuscitation (if needed), and collectors of information on the species being caught, how they were hooked/entangled, where they were captured, degree of injury (if any), and other important demographic information. NMFS believes that the presence of trained observers onboard commercial fishing vessels will ensure that injured turtles are properly resuscitated when needed. The Magnuson-Stevens Fisheries Act requires fisherman to dehook and untangle any turtles incidentally taken in these fisheries, however, NMFS has no independent verification that this is occurring, and believes that having trained observers onboard is a direct benefit to the species.

Summary of Effects - Research Activities on Sea Turtles

It is likely that all of the turtles which the observers handle will at least be stressed from

the encounter of being captured or hooked by the longline gear, and then brought aboard the vessel. Based on previous information obtained by NMFS observers operating onboard pelagic longline fishing vessels, NMFS expects that some of the turtles brought onboard will be injured, and some will have died. Injuries are likely to vary from lightly entangled turtles with good chances for survival to deeply hooked or gut-hooked turtles with significantly reduced survival prospects. Although all of the turtles will be disentangled or dehooked and treated for their injuries prior to release, the proposed research activities which will be authorized in this permit, will occur on turtles which have already experienced some level of recent trauma. Although the effects of handling, measuring, examining, tagging, and collecting tissue samples by observers previously described will occur in addition to any effects and/or injuries experienced by turtles due to fishing activities and could exacerbate any of these effects, NMFS believes the treatment provided by observers will minimize these effect of the fisheries.

Although all of the turtles will have already been stressed or injured due to their being entangled or hooked by longline gear, the conditions concerning animal handling and follow-up monitoring which will be followed by the observers is expected to minimize the risk of additional stress or injury. Turtles which are brought onboard and have the gear removed are likely to have much improved chances for survival and recovery in both the short and long-term than turtles which are not treated and retain the hooks for indefinite periods. In addition, NMFS does not expect any delayed injury or mortality of turtles following their release based on past research efforts by other researchers and adherence to certain protocols identified in the proposed action.

Shorttailed Albatross

NMFS began estimating the number of Laysan and black-footed albatross killed in the Hawaiian longline fishery in 1994. Since then, several thousand Laysan and black-footed albatross are estimated to be killed each year by fishing gear deployed by the Hawaiian longline fishery. Sighting data indicate that short-tailed albatross have been observed in the Northwest Hawaiian Islands since the 1930s. Recent information indicates that short-tailed albatross have been observed at sea where the proposed research will take place, where the Hawaiian longline fishery has historically conducted fishing operations, and where Laysan and black-footed albatross have been reported to be killed by Hawaiian longline fishing gear. The short-tailed albatross population is very low compared to historical estimates (current estimate: 1,362 birds; historical estimate: about 5,000,000 birds). Furthermore, an unknown fraction of the short-tailed albatross population temporarily resides at or passes through the Hawaiian archipelago and areas where the proposed research operations will be conducted.

To date, observations of short-tailed albatross and records of the accidental take of short-tailed albatross in fishery operations have been very few, and none of the observations of take have come from the Hawaii-based fishery. This is because very little time has been spent observing seabird interactions with the fishery, and only a few short-tailed albatross have been observed to occur in the vicinity of the fishing grounds. However, it is still

possible that take may occur as a result of the fishing operations conducted for this proposed research.

Therefore, in an effort to ensure the long-term sustainability and survival of the species, NMFS formally consulted with the Service under section 7 of the Act on this proposed research and the anticipated take that may occur as a result of interaction with short-tailed albatross.

A. Factors to Be Considered

The probability of short-tailed albatross being taken on research longline gear and reported is a function of many factors, including: (1) temporal and spatial overlap of the distribution of short-tailed albatross at sea and the distribution of longline vessels' research fishing operations, (2) albatross foraging behavior, (3) total number of baited hooks set per unit time, and the species targeted by the longline fishing vessels (*i.e.*, swordfish, in this case), and (4) use and effectiveness of seabird deterrent devices. Additional factors that contribute to the probability that individual birds will be hooked include: (1) type of research fishing operation and gear used, (2) length of time longline gear is at or near the surface of the water during the set, and to a lesser degree during the haulback, (3) behavior of the individual bird, (4) water and weather conditions (e.g., sea state), (5) availability of food (including bait and offal), and (6) physical condition of the bird. The number of birds affected by the research fishing operations is also a function of population size; as the short-tailed albatross population increases, an increase is expected in the number of birds killed. The probability of a hooked short-tailed albatross being reported is a function of (1) observer coverage (100% in the case of the proposed research), (2) the duties of the field supervisors observing the operations on vessels contracted to conduct the research and the training they receive, and (3) the observation skills and reporting accuracy of these individuals.

Temporal and Spatial Overlap

Short-tailed albatrosses have been observed in the vicinity of the NWHI between November and March. Since 1938, approximately 46 observations of about 15 different birds have been sighted from land. Short-tailed albatross have been observed from Midway Atoll (Sand and Eastern Islets), Laysan Islet, French Frigate Shoals (Tern Islet) and Kure Atoll (Green Islet). Sightings of short-tailed albatross from land represent the majority of all sightings. The Pacific Ocean Biological Survey Program produced no at-sea observations of short-tailed albatross in the vicinity of the NWHI, but this survey program was conducted at a time (1960s) when the short-tailed albatross population was very low. Only two marine observations of short-tailed albatross have been recently recorded by NMFS employees.

On March 28, 1997, a short-tailed albatross was observed during haulback operations by a NMFS fishery biologist aboard the NOAA R/V Townsend-Cromwell . In the early morning hours, the short-tailed albatross was observed to be flying in a clockwise circle over the baited hooks which were being hauled back at the starboard/stern area of the

vessel. The biologist noted that the "short-tail was actively looking for bait on hooks in the haulback." The biologist noted that at least 30 black-footed albatross and one Laysan albatross were also observed flying over baited hooks during haulback operations. The time and position of the vessel during haulback was: haulback began at 8:04am - 30°28'070" north latitude and 153°43'570" west longitude; haulback ended at 9:21am - 30°28'822" north latitude and 153°37'952" west longitude. About 150 hooks were deployed during the set.

The biologist was undertaking a study to test the effectiveness of the "Tori Pole," a device to haze seabirds from baited hooks deployed by fishing vessels. However, the Tori Pole was not deployed at the time of the sighting. During the course of the cruise, the biologist documented the behavior of at least 91 black-footed albatrosses and 6 Laysan albatrosses during five experimental sets during the period of 24-28 March 1997. The average number of hooks set per observation was 140, with a total of 700 hooks observed.

This was the first documented sighting of a short-tailed albatross from a vessel in the vicinity of the Hawaiian Islands. This was the first time staff on a research vessel cruise in the vicinity of the NWHI included a biologist trained specifically to identify seabirds and record their behavior. In the past, NOAA Corps Officers untrained in seabird identification have recorded opportunistic sightings of seabird species. Since 1989, the R/V Townsend-Cromwell has conducted about 21 longline research cruises that typically last about 15-30 days each.

On this particular cruise (Cruise TC-97-03 [TC-281], March 20 - April 18, 1997), the R/V Townsend-Cromwell operated about 480 to 780 nautical miles (889 to 1445 km) off the island of Oahu, Hawaii. Longline fishing operations were conducted using monofilament longline gear in conjunction with hook timers and time-depth recorders to study the habitat utilization, hooked longevity, and vulnerability to fishing gear of broadbill swordfish (*Xiphias gladius*). During the cruise, the crew of the R/V Townsend-Cromwell tagged, released and sampled about 76 fish. The types of fish caught during the cruise included: 26 blue sharks (*Prionace glauca*), 12 broadbill swordfish (*Xiphias gladius*), 20 mahimahi (*Coryphaena hippurus*), 16 longsnout lancetfish (*Alepisaurus borealis*), 1 albacore tuna (*Thunnus alalunga*), and 1 snake mackerel (*Gempylus serpens*).

In February 1999, fishery scientists aboard the R/V Townsend-Cromwell conducted a study to test the effectiveness of several techniques to reduce seabird interaction with swordfish longline fishing gear. A portion of the experiment was conducted within 50 nautical miles (nm) (91.45 kilometers) of French Frigate Shoals, a breeding colony for black-footed and Laysan albatross and where two short-tailed albatross have been observed. The experiment was also conducted in close proximity to Laysan Island where Laysan and black-footed albatross occur. Normally, longline fishing vessels are prohibited from entering waters closer than 50 nm (91.45 kilometers) from the islands and atolls that comprise the NWHI to avoid interaction with marine mammals. However the risk to seabirds and other protected species was considered negligible, because this was an experiment to test the effectiveness of certain seabird deterrent devices. Also, large safety

pins were substituted for hooks to hold the bait (squid - *Illex sp.*) on the line, thereby significantly reducing potential impacts to seabirds. There were no reported impacts to protected species during this experiment. Data from 24 experimental sets indicate that researchers made about 5,143 observations of black-footed albatross and about 5,178 observations of Laysan albatross, among other seabird species, trailing the vessel during the study (Boggs 2001). Observations of seabirds were recorded as far back as 980 ft (327 m) from the stern of the vessel. Observers spent approximately 100 hours documenting seabird observations as part of the study, but did not observe any short-tailed albatross. No other species of seabirds besides black-footed or Laysan albatross were observed to have interacted with the longline baits or gear.

On January 23, 2000, a short-tailed albatross was observed flying near a Hawaii-based longline fishing vessel while hauling back longline gear. The observation was recorded by a NMFS fishery observer. The sighting occurred at 0837 at 33°9'2" north latitude and 147°49'6" west longitude.

The bird was observed flying in a group of about 10 to 15 black-footed albatrosses and was in sight of the longline vessel, circling it for approximately one and a half hours. Although some of the black-footed albatrosses in this group were feeding on discarded bait, the short-tailed albatross was not observed feeding on bait. The observer judged the bird to be a juvenile. It had a bright pink and large bill with completely brown plumage. No seabird mitigation methods were employed at the time of the sighting.

On March 28, 2000, a juvenile short-tailed albatross was observed by a private citizen at the Pacific Missile Range Facility, Barking Sands, Kauai, HI (PMRF). The bird was observed at 17:30, and was observed to be resting in the grass on the mountain side of the PMRF runway.

A short-tailed albatross with band "white 000" was banded as a chick at Torishima in 1978. It was first recorded at Midway Atoll on 15 December 1984 (Tables 15 and 16). After that, it returned each year in December and left each spring, usually in April, until its disappearance in the fall of 1994. The bird was almost always seen in the same area on the south side of Sand Islet. Its pattern of behavior in the breeding season was to sit in the colony except for occasional trips of 2 or 3 days length out to sea. In March 1994, "white 000" was observed and video-taped dancing with Yellow 015, a female short-tailed albatross hatched at Torishima in 1983 that had been coming to another part of Sand Islet since 1989. "White 000" returned again in the fall of 1994 but failed to return after a routine foraging trip soon thereafter. There was heavy longline fishing activity and high black-footed and Laysan albatross mortality as measured by the observer program north of Midway Atoll during 1994. The bird has never been sighted again in any of the NWHI nor at Torishima. This bird was a young adult that had consistently established a territory over 10 years at Midway Atoll, and short-tailed albatross have no natural at-sea predators while foraging. Therefore, the Service maintains that "white 000" may have been taken in the Hawaiian longline fishery.

Foraging Behavior

Similar to Laysan and black-footed albatross, short-tailed albatross are able to locate food using well-developed eyesight and sense of smell. All three species of albatross feed at the ocean surface or within the upper three feet (one meter) by seizing, dipping or scavenging (Austin 1949, Harrison *et al.* 1983). Their diet consists primarily of squid, fish and flying fish eggs (Harrison *et al.* 1983, Austin 1949).

As demonstrated in the Alaska fishery, short-tailed, Laysan and black-footed albatross have been documented by NMFS to be killed as a result of interaction with demersal longline gear (Shannon Fitzgerald, NMFS, pers. commun. 1999). Birds attempting to steal bait may be hooked, pulled underwater as the mainline is set at its fishing depth, and drowned. In a similar manner, birds may also be killed during haulback operations. Also, if birds that attempt to steal bait are not hooked, they may be injured during the process of attempting to steal bait either from the hook, branch-line or mainline.

Hooks set per unit time and trip type

NMFS has documented the number of killed Laysan and black-footed albatross observed during haulbacks since 1994 through its Observer Program. The methodology used to estimate the number of birds killed, at 95% confidence intervals, is described in the NOAA Technical Memorandum NOAA-TM-NMFS-SWRSC-257 (NMFS 1998b).

Between 30% to 95% of birds caught on the fishing gear during deployment and haulback may fall off the hook as a result of gear deployment/haulback operations, strong currents, scavenged by predators during the soak, or cut-off by fishers during the haulback (Gales *et al.* 1998, Brian McNamara, pers. commun. 2000). Therefore, the minimum rate at which birds are estimated killed per 1,000 hooks for the years 1994 - 1998 respectively was: for Laysan albatross - 0.1523 (1994), 0.1026 (1995), 0.0727 (1996), 0.0739 (1997), and 0.0887 (1998); and for black-footed albatross - 0.1662 (1994), 0.1394 (1995), 0.1063 (1996), 0.0739 (1997) and 0.1177 (1998) (K. Foster, Service, pers. commun., 1999). Actual rates at which seabirds interact with Hawaiian longline gear maybe higher.

This information can be further refined by reporting bycatch ratios by set type , based on information from the NMFS observer database (1994 - 1998). When fishers targeted swordfish, about 370 birds were observed caught after 488 observed sets which results in a 0.758 bird catch per set ratio. When fishers targeted both tuna and swordfish, known as a mixed set, about 472 birds were caught after 946 observed sets which results in a 0.499 bird catch per set ratio. When fishers targeted tuna, about 16 birds were observed caught after 1,250 observed sets which results in a 0.01 bird catch per set ratio. Clearly, when fishers conducted swordfish or mixed sets, they experienced a higher bird catch ratio which is likely attributed to the methodology employed. However, it is evident that the risk of interaction persists when fishers target tuna, albeit at a much reduced rate.

Information in this biological opinion demonstrates that lethal interaction between Laysan and black-footed albatross species and the Hawaiian longline vessels occurs within the range of the short-tailed albatross. Because Laysan, black-footed and short-tailed

albatross species exhibit similar feeding behavior and have been documented to be killed in other U.S. fisheries, it is reasonable to assume that short-tailed albatross are at risk of injury or mortality through contact with longline fishing gear where the proposed research activities overlap with the range of the short-tailed albatross.

Seabird Deterrent Measures

NMFS' October 1999 amended proposed action (not the action under consultation here, see "Description of the Proposed Action") specified use of seabird deterrent measures and includes most of the measures that should be implemented to reduce the interaction between short-tailed albatross and Hawaiian longline vessels. However, minor modifications to that proposed action were effected in the November 2000 Opinion to better ensure that: a) seabird deterrent strategies would be implemented in areas where the short-tailed albatross foraging range may overlap with the fishery; b) the performance of the various combinations of seabird deterrent strategies would be measurable, thus providing the Service and NMFS with information to refine and improve upon seabird deterrent measures in the future; and c) the implementation of seabird deterrent strategies were consistent with recommendations from enforcement officers.

NMFS' proposal to require seabird deterrent measures for all Hawaii-based longline vessels operating north of 25° north latitude did not adequately cover areas where the short-tailed albatross may occur. A short-tailed albatross (band: yellow 047) was observed for nine days on Tern Islet, French Frigate Shoals Atoll, Hawaiian Islands NWR during the winter of 1994. The foraging range for the short-tailed albatross that visit Midway Atoll NWR, and the unknown number of short-tailed albatross that transit through the Hawaiian archipelago, may include French Frigate Shoals Atoll.

The Service reviewed the Garcia and Associates (1999) report, "Final Report, Hawaii Longline Seabird Mortality Mitigation Project, September 1999," commissioned and funded by WPRFMC, and the NMFS study conducted by C. Boggs, "Deterring Albatrosses from Contacting Baits During Swordfish Longline Sets" (Boggs 2001). These reports provided the best available scientific information regarding deterrence of seabird interactions, injuries, and mortalities associated with the Hawaiian longline fishery. These reports supported reasonable measures that the fishery should implement to reduce the potential interaction between the fishing gear and the short-tailed albatross. Furthermore, the Service concurred with NMFS that "night setting, blue-dyed and thawed bait, towed deterrent, weighted branch lines, line-setting machine and weighted branch lines, and discharge offal strategically" are, to various degrees, successful in reducing interaction and mortalities between longline gear and seabirds (Attachment K). Many of these measures will be applied in the research fishing operations, as described in the "Description of the Proposed Action."

Observer Coverage

NMFS observers have been deployed aboard industry fishing vessels since 1994 to collect fishery-related information and to record sightings of marine mammals and turtles (on Protected Species Interactions and Sighting Record forms). Observers are currently

instructed to record seabirds only if they interact with the fishing gear. With the exception of short-tailed albatross, they are specifically instructed not to record seabird sightings, only interactions (Lewis Van Fossen, NMFS, pers. commun. 1999, NMFS field manual for fishery observers, 2001). Because observers have not historically allotted a portion of their time to seabird observations, and because short-tailed albatrosses are rare, the probability is remote that a short-tailed albatross would be observed through casual sightings.

NMFS defines interaction to be contact with the gear including leaders trailing off the stern of the vessel within 300 ft (100 m) of the boat. Evidence of this contact includes observations of animals at the gear; animals stealing fish from the gear or coming in contact with the gear; and evidence of fresh marine mammal or seabird damage to the catch (not by presence of damaged fish only). Protected species retrieved during haulback are documented on a separate form, called the Protected Species Tally Sheet.

Between 1994 and 1996, observers had three options for describing deterrents that might be used by fishermen to keep birds away from fishing gear. Observers could record "yes" or "no" under "streamer," "bomb," or "other." They then were asked to describe the use of this deterrent and the results in the narrative section of their data form. In 1997, the data form was amended to include 12 different bird-catch reduction devices and techniques that could be checked off. Along with interaction and deterrent data, observers collect a suite of other information about environmental conditions, time, type of gear, technique, and location of fishing effort, which could be related to levels of bird catch. These procedures will be followed in the proposed action.

On 17 November 1998 a new instruction was issued for observers to collect and return to port any short-tailed albatross retrieved dead during longline fishing operations. The same memorandum asked that any seabirds that are retrieved alive have any line and hook removed if possible, be described and the characteristics recorded, have their leg band data recorded, be photographed, and released. These procedures will be followed in the proposed action.

The Service has provided training in seabird identification for NMFS observers on three occasions since the mandatory observer program started. An hour of instruction in seabird identification using slides was provided for the first group of observers in February of 1994. Again in 1996, the Service presented classroom instruction in identification techniques and then assisted at a session at the Bishop Museum, where new observers were able to look at actual specimens of the seabirds in question. At this time the Service also provided copies of field guides for the observers to use while at sea. The classroom and museum instruction were repeated in the fall of 1999, and again in 2000 and 2001 for new cohorts of observers. The field supervisors of the proposed experiments will all receive this training.

There was an annual average of 1,078 longline trips during the period 1994-1999. Of this, there was an annual average of 46 observed fishing trips (4.3 percent). NMFS observers

work about 10 hours per day, and reserve enough time to observe about 10% of each set during tuna trips and 3% of each set (gear deployment) during swordfish trips (L. Van Fossen, NMFS, pers. commun. 1999). The peak interaction period when seabirds interact with longline gear is during the set, although some interaction does occur during the haulback (Garcia and Associates 1999). Very little time has been dedicated to looking for short-tailed albatross during the set, when seabirds are most likely to interact with longline fishing gear. At least twice as much time will be spent observing the sets during the research fishing operations (at least 10% of each set will be observed).

Synthesis of Effects

Sea Turtles

Research activities which will be authorized under Permit # 1303 are expected to result in the take of a total of 311 (15 green, 44 leatherback, 233 loggerhead, and 24 olive ridley) turtles. Activities that will be conducted under the permit include capture using experimentally-modified commercial pelagic longline fishing gear, handling, examination, flipper and PIT tagging, tissue sampling, resuscitation (if necessary), transport of deeply hooked turtles to rehabilitation and subsequent release of these listed turtles. Conventional satellite tags and PSAT tags will be applied to up to 50 hardshelled turtles. Handling of the turtles has been limited to minimize harm. Due to the expected effectiveness of research protocols proposed by the applicant to minimize harm, the applicants' experience with these protocols and listed turtles, and special conditions placed on the permit, it is anticipated that all of the turtles will experience only short-term, non-lethal increases in stress during the handling, examination, tissue sampling, and tagging activities. NMFS does not believe that the additional activities being conducted by the observers on the turtles after they are brought aboard the vessel will cause any additional detectable adverse effects to the listed turtles. In most cases, NMFS believes the turtles will be in better condition than when they were brought aboard because they will have entangling gear and/or hooks removed, and will have additional recovery time before release. Up to 7 loggerheads, 2 leatherbacks, 2 olive ridleys and 2 green turtles may be boated dead. For the turtles that are released, injuries sustained from the capture are estimated, using precautionary assumptions, to lead to the subsequent death of up to 6 green, 15 leatherback, 87 loggerhead and 9 olive ridley turtles. Animals recorded as being boated dead are not counted in this post-release mortality estimate.

The level of mortality on greens and olive ridleys is very small and not expected to be a significant effect on the populations of any of these three species, should that take and mortality occur. The level of take and mortality of loggerhead and leatherback turtles is not trivial, though, and begins to approach the levels seen for annual takes in major fisheries. In contrast to the major fisheries, though, the proposed action has a finite period of performance, strict limits on the total level of take, and 100% observer coverage as a means to monitor and enforce those limits, rather than being a continuous activity with a limited ability to track and control sea turtle take and mortality as it occurs. Long-lived species such as sea turtles have a much greater ability to withstand periodic, limited reductions in numbers than they do to sustain a heavier, continuous elevation of total mortality. Were the level of mortality proposed in this permit continuing on an extended

(e.g. sea turtle generation time) basis, the risk posed to the species would be very much greater.

Currently, some species are already heavily impacted. As previously discussed, the Pacific population of loggerheads is declining or stable and failing to progress toward recovery goals, and the leatherback sea turtle is declining worldwide. Bycatch and mortality in fisheries are high for these species and are significant historical and ongoing contributors to their current imperilled status. Commercial pelagic longline fishing has been developing and expanding worldwide over the past several decades and, as the extent of the take of sea turtles in those fisheries has become better understood in recent years, has become a source of major concern for sea turtle conservation. In the case of the U.S. Atlantic and Hawaii-based pelagic longline fisheries, NMFS has concluded that the continued long-term operation of the fisheries, without reasonable and prudent alternatives to reduce total take, are likely to jeopardize the continued existence of species of sea turtles in the Atlantic and Pacific Oceans (Biological Opinions dated June 8, 2001 and March 31, 2001). Even with take reductions in those domestic fisheries that limit their impact to a level that would no longer represent an appreciable reduction in the species' likelihood of survival and recovery, some species of turtles still may not survive and recover, due to continuing threats in the environmental baseline, particularly fisheries bycatch.

The U.S. fleet is a small part of the international fleet that competes on the high seas for catches of tunas and swordfish. Within the area where the U.S. fleet operates in the Atlantic, the U.S. portion of fishing effort, in numbers of hooks fished is less than 10% (5-8% of hooks sampled) of the entire international fleet's effort, and likely less than that due to differences in reporting effort between ICCAT countries (NMFS SEFSC 2001, Part III, Chap. 1). Relative to foreign fishing effort and turtle impact, thus, the U.S. domestic fleet represents only a fraction. Without methods to reduce longline fishery bycatch of turtles in the U.S. and foreign fleets, the survival and recovery of endangered and threatened sea turtles may not be possible. In order to achieve comprehensive sea turtle take reductions in pelagic longline fisheries that will have a long-term significant effect on sea turtle survival and recovery, measures must be found that can be implemented by the large, international fleets that fish the entire Pacific Ocean. Fishing tactics and modified gear configurations – technical solutions – that allow longline vessels from all fleets to continue to catch target species effectively are likely to be exportable solutions that meet that requirement.

The purpose of the proposed research is to develop such technical solutions to reduce sea turtle bycatch in commercial longline fisheries while still maintaining the ability to catch target species. Very little research has been accomplished to date to address this issue. The proposed research addresses one of the most pressing conservation research questions facing sea turtles worldwide. The rapid and promising results expected from this research will provide greater benefit to sea turtle survival and recovery, before population declines continue even further.

In addition to the expected benefits towards the conservation os sea turtles, NMFS also expects to gain invaluable information about sea turtles from these experiments. NMFS expects that this information will help determine a more accurate post-hooking survival rate estimate, establish a clearer picture of loggerhead and leatherback distribution in the Pacific Ocean, and increase the available information on sea turtle life history and population demographics.

To determine the likelihood that conservation measures developed by these experiments will be adopted in domestic and foreign longline fleets, NMFS reviewed case studies of protected species conservation techniques that had been adopted by other fisheries. NMFS expects that adoption of these types of techniques in domestic fisheries will be a relatively quick process once the results are available. As necessary, NMFS may also require the adoption of these techniques to ensure that the fisheries NMFS manages are not likely to jeopardize the continued existence of sea turtles. NMFS and the United States (U.S.) have less direct influence over foreign fleets, therefore NMFS' review of the adoption of conservation measures focused on adoption by foreign nations. The reduction in the mortality of protected species caused by unintentional capture in fisheries can be attained by limiting fishing effort at some times and places, closing a fishery, reducing tow times or soak times, or modifying fishing gear to either exclude animals or prevent injuries and mortalities. Two programs that have shown success in significantly reducing injury and mortality of protected species through adoption of alternative techniques and gear by domestic and international fisheries include the "dolphin-safe" tuna program and the development and use of turtle excluder devices in trawl fisheries. A complete discussion of these two fisheries and the adoption of new techniques developed by the U.S. fishery is available in the Biological opinion prepared on the issuance of this proposed permit and is not repeated here.

The essential analysis in this EA is whether the proposed research will affect sea turtles in a way that, in combination with the environmental baseline and probable cumulative effects, is likely to appreciably reduce the likelihood of any species' survival and recovery in the wild. The level of mortality for loggerheads and leatherbacks from the proposed research is not insignificant. Because of the limited duration of the permit and its 100% monitoring, however, the taking is not expected to continue for the length of time that would be expected to produce significant population level effects. More importantly, the proposed research is expected to address a critical issue in sea turtle conservation worldwide, and sea turtle bycatch reduction techniques developed from this research will actually be used to reduce sea turtle takes that are contributing to the environmental baseline that is adversely affecting loggerheads and leatherbacks. Therefore, the effects of this proposed research are actually to appreciably *increase* the likelihood of survival and recovery in the wild for loggerhead and leatherback sea turtles.

Short-tailed Albatross

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the

Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering. Harass is defined by the US Fish and Wildlife Service (Service) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of sections 7(b)(4) and 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by NMFS so that they become binding conditions of any authorization of the proposed research as appropriate, for the exemption in section 7(o)(2) to apply. NMFS has a continuing duty to regulate the activity covered by this incidental take statement. If NMFS (1) fails to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, NMFS must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR §402.14(I)(3)].

Amount or Extent of Take Anticipated

The Service anticipates that 3 short-tailed albatross may be taken during the three-year period addressed in this consultation, based on an estimate of 1 bird per year, from 2001 through 2004, as a result of the experimental fishing activities conducted by NMFS. The incidental take is expected to be in the form of mortality or injury. The Service expects that documentation of this take will be likely because of the 100% observer coverage described for the proposed action. The Service considers the observation of a short-tailed albatross in the vicinity of the vessel, actively looking for food, to represent an unknown number or index of short-tailed albatross that may occur within the range of the research activities. Given NMFS's historically low level of observer coverage and the absence of reported observed takes of short-tailed albatross by the Hawaii longline fishery, the Service is not able to calculate the rate at which short-tailed albatross forage for bait on hooks or "strike a hook," and the number that these observations may represent in terms of birds actually killed or injured. To better understand the rate at which birds strike at hooks and are killed or injured, such taking will be considered in compliance with this Incidental Take Statement.

The Service defines "interaction" as observation of a short-tailed albatross striking at the baited hooks or mainline gear when the vessel conducts setting or haulback operations. Because an interaction is a behavior that has been documented to precede take in the form of injury or mortality in Laysan and black-footed albatrosses, for the purposes of this biological opinion, an interaction will be considered to represent a take of a short-tailed

albatross. To summarize, either an interaction or an observed injury or mortality constitutes the take of a short-tailed albatross for this biological opinion only.

The Service will not refer the incidental take of any migratory bird (in this case, short-tailed albatross) for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. §§703-712), if such take is in compliance with the terms and conditions (including amount and/or number) specified herein.

Effect of the Take
The Service has estimated that 1 short-tailed albatross per year (or 3 for the duration of this consultation) may be taken as a result of the proposed action from the year 2001 through 2004. However, this is only an estimate, based on certain assumptions relative to the bird's behavior and appearance within the area of the Hawaiian islands and its possible interaction with the longline fishery activities.

The Service does not believe that this level of take is likely to result in jeopardy to the species, nor will it result in destruction or adverse modification of critical habitat, as critical habitat is not designated in the project area.

Reasonable and Prudent Measures
The Service believes that the following reasonable and prudent measures are necessary and appropriate to minimize the impact of the incidental take of short-tailed albatrosses:

1.00 Minimize attraction of short-tailed albatross to fishing gear used in the proposed research.
1.00 Monitor the level of take and measures to minimize take.
1.00 Ensure survivability of injured short-tailed albatrosses.

Terms and Conditions
In order to be exempt from the prohibitions of section 9 of the Act, NMFS must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and specify reporting requirements. These terms and conditions are non-discretionary.

In order to implement reasonable and prudent measure I above, the following terms and conditions apply:

I.A. Implementation Timeframe: NMFS shall require longline fishing activities conducted in connection with this research to comply with seabird deterrent-related measures as stated in the Proposed Action and in the terms and conditions of this biological opinion, where said fishing activities overlap with the known range of the short-tailed albatross, whether fishing activities occur within the EEZ or in international waters (*e.g.*, high seas).

I.B. Seabird Deterrent Measures: NMFS shall implement the following mandatory seabird-deterrent measures for all research fishing activities north of 23° north latitude. For the purposes of this opinion, the Service adopts the NMFS definition of shallow sets when deploying longline gear. This definition is described in the *Federal Register* (Vol.. 65, No. 214, November 3, 2000, pages 66186 - 66188).

Summary (by experiment) of seabird deterrent measures to be implemented in the proposed research

Experiment	No. of Sets/Year	Blue-Dyed Bait	Thawed Bait	Strategic Offal Discharge	Night Sets	Line Setting Machine & Weighted Branch Lines
A. Swordfish-style control fishing	1: 550 2: 520 3: 520	no	yes	yes	yes	no
B. Swordfish-style fishing w/blue-dyed bait and 40-fathom distance between float lines and nearest branch lines	1: 520 2: 520 3: 520	yes	yes	yes	yes	no
C. Swordfish-style fishing with "stealth" gear	1: 30	yes	yes	yes	yes	no
D. Deep longline sets w/light sticks	1: 30	no	yes	yes	no	yes
E. Swordfish-style fishing with hook timers	1: 180 2: 180	no	yes	yes	yes	no

The number of sets in A, B, and E may be greater or less than these approximations, which are the estimated number of sets required to obtain an expected number of sea turtle takes (121 turtles per year for the three years of the proposed research; see NMFS' section 10 permit application, Table 7, for breakdown of takes by species). If the required number of turtle takes occurs on fewer sets the experiments will be terminated, and fishing operations will cease regardless of the number of contracted sets. If the required number of sea turtles are not taken, more sets may be undertaken, so long as the incidental take limit of one short-tailed albatross per year is not exceeded.

I.B.(1). The proposed research must employ the following mandatory measures when setting and hauling the longline gear north of 23° north latitude:

a). Blue-dyed and thawed bait:
An adequate quantity of blue dye must be maintained on board, and only bait dyed a color that conforms to WPRFMC/NMFS standards may be

used. **All bait** must be completely thawed. All bait used in Experiments B and C, above, must be dyed blue before the longline is set.

b). Discharge offal strategically (Mandatory For All Sets):
While gear is being set or hauled, fish, fish parts or bait must be discharged on the opposite side of the vessel or vessel's stern from which the longline is being set or hauled. All hooks must be removed from offal and spent baits prior to discharge. If a swordfish is landed, the liver must be removed and the head must be severed from the trunk, the bill removed and the head cut in half vertically. The heads and livers must be periodically thrown overboard from which the longline is being set or hauled. Because the supply of offal may be low when fish catch rates are low or tuna are the target species, this mitigation method requires the preparation and storage of offal for use during the longline set. The strategic discharge of offal will be employed by all fishing operations connected with the proposed research. This deterrent measure will be especially important in Experiment D., which does not employ dyed bait or night setting.

c). Night setting (Mandatory For Shallow Sets Only):
The longline set must begin at least one hour after sunset and the set must be completed by sunrise, using only the minimum vessel lights necessary for safety. Night Setting shall be employed in all sets in Experiments A, B, C, and E.

d). Setting Machine with weighted branchlines (Mandatory For Deep Sets Only):
The longline must be set with a line-setting machine (line shooter) so that the longline is set faster than the vessel's speed. In addition, weights of at least 45 grams must be attached to branch lines within one meter of each baited hook. Setting Machine with weighted branchlines shall be employed in all sets in Experiment D.

I.B.(2). Hawaii-based longline fishers may employ the following measures when setting and hauling the longline gear north of 23° north latitude:

a). Weighted Branch Lines (Optional):
At least 45 grams of weight may be attached to branchlines within one meter of each baited hook. Weighted branchlines may be employed in all research sets.

b). Towed Deterrents (Optional):
A line with suspended streamers (tori line) or a buoy that may conform to Council/NMFS standards may be deployed when the longline is being set and hauled. Towed deterrents may be employed in all research sets.

I.C. Annual Workshops: Operators, captains, and personnel of vessels involved in the proposed research must attend NMFS annual Protected Species workshops to inform fishers of the risk of mortalities in the Hawaiian longline fishery to short-tailed albatross. At least one annual workshop is conducted each year. The workshops include: information exchange between NMFS, the WPRFMC, and fishers about: (1) the use of effective seabird deterrent devices in the fishery, and (2) status of the short-tailed albatross population and observations of the bird in the vicinity of the Hawaiian longline fishing area. Translations are provided to Vietnamese and Korean speaking fishers with regards to all educational materials distributed to vessel captains.

I.D. Albatross Species Identification Card: Plastic-coated, weatherproof, cards that illustrate albatross species (e.g., short-tailed, Laysan and black-footed albatross) for identification purposes, shall be distributed to all fishers participating in the proposed research. Cards translated into the Korean and Vietnamese languages should be distributed to those fishers whose first language is either Korean or Vietnamese.

In order to implement reasonable and prudent measure II above, the following terms and conditions apply:

II.A. (1). Notification of Permit Changes: Because this research will take place under a section 10 permit issued by NMFS for the take of sea turtles in scientific research, and because there exist no regulations to implement the Terms and Conditions of the November 2000 Opinion for shallow-set longline activities, NMFS will notify the Service immediately if any change is made to the field design of the proposed research (e.g., the number of sets conducted) or if any changes to the permit are made that in any way affect the proposed action.

(2). Annual Reporting: NMFS shall report annually the observed and estimated total number of interactions of Laysan and black-footed albatross, and observed take of short-tailed albatross in the longline fishing experiments, by fishing set type (i.e., deep sets [tuna] or shallow sets [swordfish/mixed] as defined by NMFS). The information about interactions between only short-tailed albatross and longline gear in the proposed research would not provide us or NMFS with sufficient information to gauge the effectiveness of the various combinations of seabird deterrent measures/devices. Therefore, to gauge the effectiveness of these seabird deterrents it is appropriate to collect data from surrogate species (*e.g.* Laysan and black-footed albatross) that exhibit similar foraging behavior to the short-tailed albatross. NMFS currently records observed interactions and estimates total number of interactions for these species.

In addition to reporting interactions and any take as noted above, NMFS shall evaluate the effectiveness of seabird deterrent measures in reducing interactions with short-tailed albatross by measuring the rate at which Laysan and black-footed

(and short-tailed, if any) albatross are caught by longline vessels participating in the research. NMFS shall evaluate and report on the effectiveness of the seabird deterrent regime on an annual basis.

Within two months from the end of each fishing season for the three years of the experiment, NMFS will report to the Service on the effectiveness of seabird deterrent measures (example: if the seasonal duration of the proposed research is December 2001 through May 2002, the report would be due by August 1, 2002). The report will include (by each trip and summarized over all trips) all reported observations and mortalities of Laysan, black-footed, and short-tailed albatross, including date, time, location, vessel, vessel type, vessel size, trip type (i.e., swordfish, tuna, or mixed), gear description, total number of hooks deployed, total number of trips, and all observer or reported comments. These annual reports will be submitted by August 1 following each fishing season to: Field Supervisor, U.S. Fish and Wildlife Service; Pacific Islands Fish and Wildlife Office; 300 Ala Moana Boulevard; Room 3-122, Box 50088; Honolulu, Hawaii 96850; telephone (808) 541-3441, facsimile (808) 541-3470.

In the event a NMFS observer sights a short-tailed albatross during a trip, NMFS shall make arrangements for the Service to interview the observer. The interview will occur no later than 30 days from the time the fishing trip ended. NMFS shall make available to the Service copies of all information (*e.g.* records, pictures) collected by the observer about the sighting.

II.B. (1). Observer coverage: Observer coverage of the proposed research will be 100%. Every trip will have aboard a field supervisor whose primary duties will be to observe endangered species during sets and haulbacks. Fishery related activities will be considered a secondary duty and will be limited to ensuring that vessel crew tag fish carcasses in Experiments A and B. The observer may participate in this activity when the haul is completed or when observer duties for endangered species are completed. The satellite tagging and release of live fish during haulback operations may be undertaken for no longer than 30 minutes per haulback operation, or when the observer deems that albatross are no longer observed in the vicinity of the fishing gear being retrieved.

(2). Observer training: Field supervisors for the field experiments will receive training in seabird identification as part of their training as fishery observers.

II.C. Short-tailed albatross observer duties: NMFS shall deploy field supervisors/observers aboard all longline vessels conducting research. These observers are responsible for recording data directly connected with the experiments to test the effectiveness of sea turtle deterrents and recording data on seabird behavior and interaction with longline gear during the period of this consultation.

Field supervisors shall record sightings and behavior of short-tailed, Laysan and black-footed albatross during the set and haulback of the main line. Observers will record seabird sightings and behavior in the vicinity of the longline gear during at least 10% of each longline setting operation, or until the observer deems that seabirds are no longer observed in the vicinity of the deployed fishing gear, or in the case of night sets, that the observer can no longer distinguish between seabird species. Similarly, observers will record seabird sightings and behavior in the vicinity of longline gear during longline haulback operations, until the observer deems that seabirds are no longer observed in the vicinity of the fishing gear being retrieved.

Field supervisors shall monitor sightings of short-tailed, Laysan and black-footed albatross on or near longline gear. Field supervisors will consider observations and takes of short-tailed albatross, and other endangered species including sea turtles, to be the top priorities over other observer duties. The observer will record the behavior of the short-tailed albatross and other seabirds observed, describing their location in relation to the longline gear, and whether they attempt to strike at the gear to "steal bait," whether they swallowed bait, and whether they are either hooked onto or injured by the gear. The observer will record their behavior, the species of each bird that attempts to strike at fishing gear, and record the number of birds striking at the fishing gear per set and per haulback. The observer will record the number of albatross, by species, that are hauled back on longline gear. The observer will record whether the albatross was killed or injured during the haulback. If the albatross was recorded as injured, the observer will describe the extent of the injury to the best of their ability. In addition to the above-mentioned information, written reports will include: the date of the set, the type(s) of seabird deterrent measures used, weather conditions (wind velocity, precipitation, visibility and sea state), time set began and ended, latitude and longitude the set began and ended, number of hooks set, bait type (and whether it was frozen or thawed), amount of weight on hooks, number of birds within the vicinity of the vessel at the beginning of the set, bird behavior before and during set, time haulback began and ended, latitude and longitude haulback began and ended, a record of the number of birds, by species, touching the gear and their fate and condition. These data will be included as an appendix to the annual report as identified in Term and Condition II.A. (2), above.

In order to implement reasonable and prudent measure III above, and as incidental take is permitted for this listed species, the following terms and conditions apply:

III.A. NMFS shall advise fishers and observers that every reasonable effort must be made to save injured short-tailed albatross. See Appendix C for the complete U.S. Fish and Wildlife Service *Handling & Release Guidelines for Short-tailed Albatross Hooked or Entangled in the Hawaiian Longline Fishery.* If a short-tailed albatross is recovered alive, it must be retained unless it exhibits all of the following traits:

1. head is held erect and bird responds to noise and motion stimuli;
2. bird breathes without noise;
3. both wings can flap and retract to normal folded position on back;
4. bird can stand on both feet with toes pointed in the proper direction (forward); and
5. bird's plumage is completely dry.

If a recovered albatross exhibits all of these traits, it should released overboard. If the recovered bird fails to exhibit even one of the above traits, it must, by law, be retained aboard and the NMFS contacted immediately. The U.S. Coast Guard may be contacted to facilitate communication between the vessel and the NMFS. The appropriate NMFS personnel will be contacted at any one of the following telephone numbers (by availability, in the order listed):

Lewis Van Fossen	808/973-2935 extension 214
Kevin Busscher	808/973-2935 extension 215
Charles Karnella	808/973-2937

III.B. NMFS shall instruct field supervisors and fishers that every effort must be made to recover any dead short-tailed albatross. Specimens shall be frozen immediately, with identification tags attached directly to the carcass, and a duplicate identification tag attached to the bag or container holding the carcass. Identification tags shall include species, date of mortality, name of vessel, location (latitude and longitude) of mortality, observer or captain's name (or both), and any band numbers if the specimen has a leg band. Leg bands must remain attached to the bird.

III.C. NMFS shall inform field supervisors and fishers that specimens must be surrendered, as soon as possible to a NMFS or Service office. Specimens must remain frozen and must be shipped as soon as possible to: Vertebrate Conservation Coordinator, Ecological Services, Pacific Islands Fish and Wildlife Office, US Fish and Wildlife Service, Room 3-122, Honolulu, Hawaii 96850. The contact numbers for the Pacific Islands Fish and Wildlife Office are: 808/541-3441(telephone), 808/541-3470 (facsimile).

Summary of Reporting Requirements
Please note that the following is only a summary and reporting details are included in the terms and conditions above.

NMFS shall report immediately any changes to the design of the field research or the section 10 permit (from Term and Condition II.A. (1)).

NMFS shall report annually by August 1 the observed and estimated total number of interactions of Laysan and black-footed albatross, and observed take of short-

tailed albatross, by fishing set type (i.e., deep set [tuna] or shallow set [swordfish/mixed] as defined by NMFS) (from Term and Condition II.A (2)).

NMFS shall evaluate annually the effectiveness of all required seabird deterrent devices by measuring the rate at which Laysan, black-footed, and short-tailed albatrosses are caught by Hawaiian longline vessels participating in the proposed research, by set type (from Term and Condition II.A).

NMFS observers shall record sightings of Laysan, black-footed, and short-tailed albatrosses during the set and haulback of the main line (from Term and Condition II.C).

4.3.3 Alternative 3 - Issue the permit based on a high confidence sampling for the minor gear modification (test use of blue-dyed bait and moving branch line)

Sea Turtles

The number of sea turtle takes would be higher then anticipated for the Proposed Action (Alternative 2) and are 330 threatened loggerhead turtles, 33 threatened/endangered olive ridley turtles, 18 threatened/endangered green turtles and 63 endangered leatherback turtles over the life of the permit. These direct takes will be the only take of sea turtles in the Pacific Ocean by swordfish style fishing, however, they are in addition to the incidental take expected in the commercial fishery operating in other areas authorized in the Incidental Take Statement of the March 29, 2001, opinion.

Detailed analysis of the effects on each of the individual sea turtle species proposed to be taken under permit #1303 are evaluated in the biological opinion prepared on the issuance of this proposed permit, and are not repeated here. A similar analysis on population effects for each of the species was not conducted under this alternative because it was rejected during the development of the proposed research plan due to the increase in sampling especially the critically endangered leatherback (36 taken in Alternative 2 Proposed Action; 63 taken under Alternative 3). The description of effects on individual sea turtles (i.e. forced submergence, entanglement, trailing gear, hooking, transportation, tagging, tissue sampling, attachment of satellite transmitters, presence of observers and researchers) described in the Proposed Action (4.2.3) on individual sea turtles is the same under this alternative.

Short-tailed Albatross

A detailed description of the effects on short-tailed albatross as a result of the proposed activities to be taken under permit #1303 are evaluated in the USFWS biological opinion issued on December 12, 2001 and are not repeated here. A similar analysis on population effects for this species was not conducted under this alternative because it was rejected during the development of the proposed research plan due to the increase in sampling especially the critically endangered leatherback. This alternative would approximately double the number of sets and thus, would increase the chance of an interaction.

4.3.4 Alternative 4 - Issue the permit based on a one-year design

Sea Turtles

The number of sea turtle takes would be lower then anticipated for the Proposed Action (Alternative 2) and are 61 threatened loggerhead turtles, 6 threatened/endangered olive ridley turtles, 4 threatened/endangered green turtles and 12 endangered leatherback turtles over the life of the permit. These direct takes will be the only take of sea turtles in the Pacific Ocean by swordfish style fishing, however, they are in addition to the incidental take expected in the commercial fishery operating in other areas authorized in the Incidental Take Statement of the March 29, 2001, opinion.

Detailed analysis of the effects on each of the individual sea turtle species proposed to be taken under permit #1303 are evaluated in the biological opinion prepared on the issuance of this proposed permit, and are not repeated here. A similar analysis on population effects for each of the species was not conducted under this alternative because it was rejected during the development of the proposed research plan due to the insufficient data that would be collected on leatherbacks. Under this alternative, the minor gear modification (blue-dyed bait and moving branch line) could not be analyzed for significance in reducing leatherback interactions due to the insufficient sampling. Under this alternative the hook timer and piggyback hook experiments would not be conducted. Based on research conducted on fish (Boggs, 1992), the applicants anticipate that 30 hook timer readers (i.e. 30 observations of a sea turtle species taken by longline) are needed in order to detect trends in turtle capture time or depth. Based on historical take levels in the swordfish fishery, the applicants anticipate that two years are needed for this portion of the experiment. This alternative would unnecessarily delay the testing of treatments for leatherback takes.

The effects on individual sea turtles (i.e. forced submergence, entanglement, trailing gear, hooking, transportation, tagging, tissue sampling, attachment of satellite transmitters, presence of observers and researchers) described in the Proposed Action (4.2.3) is the same under this alternative.

Short-tailed Albatross

A detailed description of the effects on short-tailed albatross as a result of the proposed activities to be taken under permit #1303 are evaluated in the USFWS biological opinion issued on December 12, 2001 and are not repeated here. A similar analysis on population effects for this species was not conducted under this alternative because it was rejected during the development of the proposed research plan. The effects on individual animals described in the Proposed Action (Alternative 2 - 4.2.3) is the same under this alternative. This alternative would reduce the number of sets and thus, would decrease the chance of an interaction.

4.3.5 Alternative 5 - Issue the permit without the stealth gear and deep-set daytime fishing CPUE

Sea Turtles

The 'stealth gear' and deep-set daytime fishing takes (8 threatened loggerheads, 2 threatened/endangered olive ridleys, 1 threatened/endangered greens, and 2 endangered

leatherback turtles would not occur under this alternative. The remaining takes in the minor gear (blue-dyed bait and moving the branch line) and the hook timer testing will be the only take of sea turtles in the Pacific Ocean by swordfish style fishing, however, they are in addition to the incidental take expected in the commercial fishery operating in other areas authorized in the Incidental Take Statement of the March 29, 2001, opinion.

Detailed analysis of the effects on each of the individual sea turtle species proposed to be taken under permit #1303 are evaluated in the biological opinion prepared on the issuance of this proposed permit, and are not repeated here. A similar analysis on population effects for each of the species was not conducted under this alternative because it was rejected during the development of the proposed research plan. Testing major gear modifications for target species CPUE is a critical first step in determining the feasibility of implementing these modifications in the fishery. Modifications to gear or fishing practices that result in extremely low catch of the intended target species likely would not be used by the industry given the decreased catch may not cover the cost of the operation. Conducting tests on the efficacy of stealth fishing gear and daytime deep sets to reduce sea turtle interactions without first determining target species CPUE would result in unnecessary turtle takes. Eliminating the stealth fishing gear and deep-set daytime for target CPUE would delay testing for turtle bycatch if the minor gear modification experiments are determined not to be effective after the first year of the experiment.

The effects on individual sea turtles (i.e. forced submergence, entanglement, trailing gear, hooking, transportation, tagging, tissue sampling, attachment of satellite transmitters, presence of observers and researchers) described in the Proposed Action (Alternative 2 - 4.2.3) is the same under this alternative.

Short-tailed Albatross
A detailed description of the effects on short-tailed albatross as a result of the proposed activities to be taken under permit #1303 are evaluated in the USFWS biological opinion issued on December 12, 2001 and are not repeated here. A similar analysis on population effects for this species was not conducted under this alternative because it was rejected during the development of the proposed research plan. The effects on individual animals described in the Proposed Action (Alternative 2 - 4.2.3) is the same under this alternative. This alternative would reduce the number of sets and thus, would decrease the chance of an interaction.

4.4 Effects of all alternatives on economic resource issues.

4.4.1 Alternative 1 - No Action (No Permit Issued)

In the March 30, 2001 EIS, NMFS evaluated the economic effects of preventing vessels managed under the PFMP from using sword-fish style longline fishing methods north of the Equator as the preferred alternative (Alternative #10 in the EIS). If NMFS-OPR denies the permit, the current status quo will remain the same and there will be no swordfish style fishing conducted north of Hawaii in the closed area by U.S. flag vessels.

4.4.2 Alternative 2 (Proposed Action) - Issuance of the permit as requested by the applicant

The research project calls for conducting 1,370 longline sets in the first year and 1,220 and 1,040 sets in the second and third years using commercial longline vessels contracted to conduct the turtle bycatch reduction experiments. The numbers of sets needed each year are estimates that will vary as needed to achieve the target number of turtle take observations required for the chosen level statistical power. NMFS Honolulu Laboratory has contracted 16 longline vessels to conduct the first years work, pending issuance of the ESA Section 10(a)(1)(A) permit. Contracts were awarded via a competitive procurement process which included negotiations. Offers were made under the condition that vessels would keep and sell the fish catch. Funding has been secured for CY2001 and this funding is expected to occur at this level in FY2002 and FY 2003. The proposed research permit will expire on January 31, 2005.

Vessels that participate in the research under the research permit will be allowed to use commercially banned swordfish-style longline fishing gear as well as tuna-style fishing gear in controlled experiments to test whether certain changes to the appearance or configuration of the gear reduce turtle bycatch and or reduce target species catch rates and revenues. The collection of revenue data from the sale of the fish catch is an essential aspect of the experiment. A majority of the contracted vessels have historically fished in the Hawaii-based fishery using fishing gear that is now banned for commercial fishing.

The negative economic effects of preventing vessels managed under the FMP from using swordfish-style fishing methods north of the equator (March 30, 2001 EIS) would be reduced by about 1/3 through the proposed action because that is about the proportion between the swordfish longline operations in the proposed action and the commercial swordfish longline operations that were banned. The proposed action will restore about 1/3 of the economic activity lost under the swordfish gear ban.

A. Gear modification (test use of blue-dyed bait and moving branch line)

Two modifications to fishing practices which have been determined to have promise for reducing turtle takes while having only minor impacts (if any) on fishing performance (target species CPUE) are the use of squid bait dyed blue with food coloring and the removal of branch lines attached to the main line closest to the float line attachment points. Therefore, the first portion of the proposed research would simultaneously test a combination of these two experimental gear modifications as a single experimental fishing treatment against a control. The experiment would test the effect of longlining for swordfish using blue-dyed bait and moving the nearest branchlines to at least 40 fathoms from the nearest floatline and comparing this method to standard (i.e. control) fishing operations. Data analyses and results would determine the efficacy of the combined method for reducing sea turtle bycatch, compared to normal fishing operations. This portion of the experiment will involve the majority of time and effort (3 years) and will employ 8 full-time vessels. Equal numbers of treatment and control operations (sets) will be conducted but the total number of sets listed is just an estimate based on historical capture rates of turtles by swordfish style fishing gear (leatherbacks - 0.0154/set;

loggerheads - 0.0829/set; olive ridley - 0.0078/set; green - 0.0044/set). Again, the statistical properties of Poisson-distributed data are such that the number of sets is not critical to the test, and the experiment will be limited to the number of turtle takes required, not the number of sets estimated. If more sets are needed to reach the required number of observed turtle interactions, additional fishing operations will be contracted. The estimated total number of sets per year for this portion of the experiment will be 1,039, a third of the 3,117 sets that may be required over three years.

B. Testing "stealth gear" and deep-set daytime fishing for CPUE viability

Because of sea turtles' association with floating objects and possible attraction to anomalies in what otherwise is a featureless ocean, the applicant proposes to test the use of "stealth" gear - longline gear that has been camouflaged in order to be less visible to sea turtles. Before determining whether this major gear modification may reduce sea turtle interactions, the applicants first want to ensure that CPUE of target species using these modifications is still comparable to standard longline fishing. Therefore, reducing the visibility of longline gear to sea turtles by using "stealth" longlines with major gear modifications is proposed for testing viability in maintaining target species CPUE in both swordfish-style (shallow set, nighttime) and tuna-style (deep-set, daytime) fishing operations and comparing to standard (i.e. controlled) swordfish- and tuna-style operations. Any information regarding sea turtle interaction rates will be secondary.

The treatment sets will utilize floats that are blue on the bottom and orange on top, and control sets will utilize typical floats that are orange all over. The treatment sets will also use dark grey monofilament for main line, float lines, and branch lines, while the control sets will use typical longline gear (i.e. visible). Battery powered, narrow-frequency, yellow light emitting diode- (LED) based, down-welling (shaded on the upper half) light sticks will be used on stealth gear (treatment), and regular yellow chemical light sticks will be used on standard gear (control). Lastly, for stealth gear (treatment), the metallic shine of the branch line and float line snaps will be removed or they will be painted, and the bait will be dyed blue (described in Boggs (2000)), while controls will use natural (i.e. un-dyed) squid and longline gear used by typical Hawaii-based longline fishers. The applicants have stated that they need at least 3 fishing trips (i.e. 30 sets) with controls for a credible demonstration in both types of fishing operations. Therefore, there will be 30 control sets and 30 treatment sets each for swordfish-style and for tuna-style fishing operations (120 sets total).

Information will be collected on sea turtle bycatch during this portion of the experiment, but because few sets will be needed to determine differences in CPUE, there will not be a sufficient number of sets to determine statistically whether stealth gear reduces sea turtle interactions. Based on the number of sets needed to test CPUE viability, and on historical

catch rates of the four species of turtles likely to be encountered by both swordfish-style[6] and tuna-style[7] fishing, the applicants have estimated the number and species taken (and killed) during this portion of the experiment.

Similar testing of target species CPUE is proposed for deep-set daytime swordfish fishing. This proposed method would target swordfish deep, where they descend during the day, using swordfish-type bait and lightsticks in areas where near-surface nighttime swordfish abundance is high. Deep daytime fishing operations for swordfish will use a depth configuration comparable to that of tuna gear, which will be modified based upon results expected within the next few months from swordfish recently tagged with pop-up satellite transmitting archival tags (PSATs). These tags will report the typical daytime depth distribution of swordfish. Target depth will be achieved using a main line shooter and a much greater length of main line and greater number of hooks between floats while maintaining the standard swordfish-style number of branch lines per set. Depth will be measured with time-depth recorders to ensure target depths are achieved. The applicants have stated that 30 sets will be needed to demonstrate target species CPUE viability.

Information will be collected on sea turtle bycatch during this portion of the experiment, but because few sets will be needed to determine CPUE viability, there will not be a sufficient number of sets to determine statistically whether deep set daytime fishing for swordfish reduces sea turtle interactions. Based on the number of sets needed to test CPUE viability, and on historical catch rates of the four species of turtles likely to be encountered by swordfish-style fishing, the applicants have estimated the number and species taken (and killed) during this portion of the experiment. These take levels have been combined with the estimates for the "stealth" gear experiment and are presented in Table 5.

Every effort would be made to avoid taking any turtles in the stealth and deep swordfish fishing tests for target species CPUE. This will be accomplished by trying to schedule direct experimental fishing effort to times and areas where the target fish species CPUE was historically high and the turtle take rates were low. No sea turtle takes are needed for initial tests of these methods, which are intended to demonstrate CPUE, although some loggerheads, a few leatherbacks, olive ridleys, and green turtle takes are anticipated, based on historical interaction rates in the Hawaii-based longline fishery.

---

[6]Applicants have used the following sea turtle interaction rate based on historical takes in the Hawaii-based longline fishery using swordfish-style fishing: 0.0044 greens/set; 0.0154 leatherbacks/set; 0.0829 loggerheads/set; and 0.0078 olive ridleys/set.

[7]Applicants have used the following sea turtle interaction rate based on historical takes in the Hawaii-based longline fishery using tuna-style fishing: 0.0025 greens/set; 0.0055 leatherbacks/set; 0 loggerheads/set; and 0.0153 olive ridleys/set

The stealth and deep day swordfish experiments will be conducted at the same time, and in the same area, with three vessels: one conducting control operations to demonstrate high near-surface abundance of target species, another conducting stealth tests, and the third conducting deep daytime fishing for swordfish. Thus there will be some economizing of the control operations to serve two purposes. In testing the stealth gear with tuna style fishing there will be only two vessels, as both stealth and control fishing operations will be conducted deep during the day. The vessels would fish south of the Hawaiian Islands, in areas currently open to Hawaii-based tuna fishing operations. This portion of the experiment is estimated to last no longer than one year. In addition, with a low number of sets, these experiments are expected to have low levels of sea turtle take.

Table 5. Stealth gear and deep daytime swordfishing tests to demonstrate CPUE viability

Number of sets			Synoptic Vessels	Total Turtle Takes/Mortalities (one year experiment)							
Control	Stealth	Deep Day		Leatherback		Loggerhead		Olive ridley		Green	
60	60	30	3	2	1	8	3	2	1	1	1

C. Testing use of hook timers and hook type

Measuring trends in the time and depth of sea turtle captures could reveal particular time intervals or depths of longline operations for which sea turtles are most vulnerable, revealing possible modifications to fishing operations for future testing. The use of hook timers, in conjunction with time-depth recorders (Boggs, 1992) is proposed for this purpose. Hook timer experiments will be conducted using standard swordfish style gear fitted with hook timers as described by Boggs (1992). No controls are used, and the comparison is between different times and depths within the combined fishing operations. Based on research conducted on fish (Boggs, 1992), the applicants anticipate that 30 hook timer readers (i.e. 30 observations of a sea turtle species taken by longline) are needed in order to detect trends in turtle capture time or depth. Based on historical take levels in the swordfish fishery, the applicants anticipate that two years are needed for this portion of the experiment.

The testing of large (18/0) circle hooks for the viability of target species CPUE is proposed as a piggyback project during the hook timer measurements. Therefore, this experiment will utilize alternating "J" and 18/0 circle hooks on all hook timer operations. The applicants anticipate that this portion of the experiment will only require one year to demonstrate credible results. Experiments comparing 16/0 circle and J hooks in the Azores (Bolton and Bjorndal, 1999) and in the North Pacific (LaGrange, 2001) reduced the severity of injury of a hooked turtle; however the target species CPUE was reduced the by 30-50%. Both Bolton (personal communication) and LaGrange (personal communication) have suggested that larger (18/0) circle hooks could increase the viability

of target species CPUE. Therefore testing larger circle hooks is proposed for this purpose. Because testing of different hook types differs only in their mechanical effects after a target species (or turtle, in the hook timer portion of the experiment) interacts with the hook, treatment and controls can be applied independently on the same set without pseudo-replication. If the 18/0 circle hooks are as effective at catching target species as the standard J hook, then the implementation of this gear modification in longline fisheries may reduce the severity of sea turtle injuries, thereby increasing post-release survivability.

4.4.3 Alternative 3 - Issue the permit based on a high confidence sampling for the minor gear modification (test use of blue-dyed bait and moving branch line)

Vessels that participate in the research under this alternative will be allowed to use commercially banned swordfish-style longline fishing gear as well as tuna-style fishing gear in controlled experiments to test whether certain changes to the appearance or configuration of the gear reduce turtle bycatch and or reduce target species catch rates and revenues. The collection of revenue data from the sale of the fish catch is an essential aspect of the experiment. A majority of the contracted vessels have historically fished in the Hawaii-based fishery using fishing gear that is now banned for commercial fishing.

Under this alternative, an additional 9 vessels will participate and be able to collect revenue from the sale of the fish caught under the experiment. The cost of contracting the additional vessels would be about 50% greater than for the Proposed Alternative (2). The negative economic effects of preventing vessels managed under the FMP from using swordfish-style fishing methods north of the equator (March 30, 2001 EIS) would be reduced by about one-half because that is about the proportion between the swordfish longline operations in this alternative and the commercial swordfish longline operations that were banned. This alternative would restore about one-half of the economic activity lost under the swordfish gear ban.

4.4.4 Alternative 4 - Issue the permit based on a one-year design

Vessels that participate in this will be allowed to use commercially banned swordfish-style longline fishing gear as well as tuna-style fishing gear in controlled experiments to test whether certain changes to the appearance or configuration of the gear reduce turtle bycatch and or reduce target species catch rates and revenues. The collection of revenue data from the sale of the fish catch is an essential aspect of the experiment. A majority of the contracted vessels have historically fished in the Hawaii-based fishery using fishing gear that is now banned for commercial fishing.

Under this alternative, the same numnber of vessels would initially participate compared to the Proposed Action (Alternative 2) and collect revenue from the sale of the fish caught under the experiment. However, under this alternative, the vessels will collect revenue over a one year period compared to three years in the Proposed Action (Alternative 2).

Assuming similar revenue between years, vessels would lose 2/3 of their revenue under this alternative compared to the Proposed Action (Alternative 2). The negative economic effects of preventing vessels managed under the FMP from using swordfish-style fishing methods north of the equator (March 30, 2001 EIS) would be reduced by about 1/3 in one year because that is about the proportion between the swordfish longline operations in this alternative and the commercial swordfish longline operations that were banned. However, over three years, this alternative will restore only about 1/9 of the economic activity lost under the swordfish gear ban.

4.4.5 Alternative 5 - Issue the permit without the stealth gear and deep-set daytime fishing CPUE

Vessels that participate in the research under this alternative will be allowed to use commercially banned swordfish-style longline fishing gear in controlled experiments to test whether certain changes to the appearance or configuration of the gear reduce turtle bycatch. The collection of revenue data from the sale of the fish catch is an essential aspect of the experiment. A majority of the contracted vessels have historically fished in the Hawaii-based fishery using fishing gear that is now banned for commercial fishing.

Under this alternative, approximately 3 vessels would not be able to participate compared to the Proposed Action (Alternative 2) and collect revenue from the sale of the fish caught under the experiment. The negative economic effects of preventing vessels managed under the FMP from using swordfish-style fishing methods north of the equator (March 30, 2001 EIS) would still be reduced by about 1/3 because that is about the proportion between the swordfish longline operations in this alternative and the commercial swordfish longline operations that were banned. Two of the three vessels that would be eliminated in this alternative are contracted to use tuna-style gear and would continue to fish legally in the fishery. Moreover they would have the same or higher probability of catching the estimated number of turtles in the commercial fishery. This alternative will restore about 1/3 of the economic activity lost under the swordfish gear ban.